

CSEE 4840 Embedded System

PAC XON



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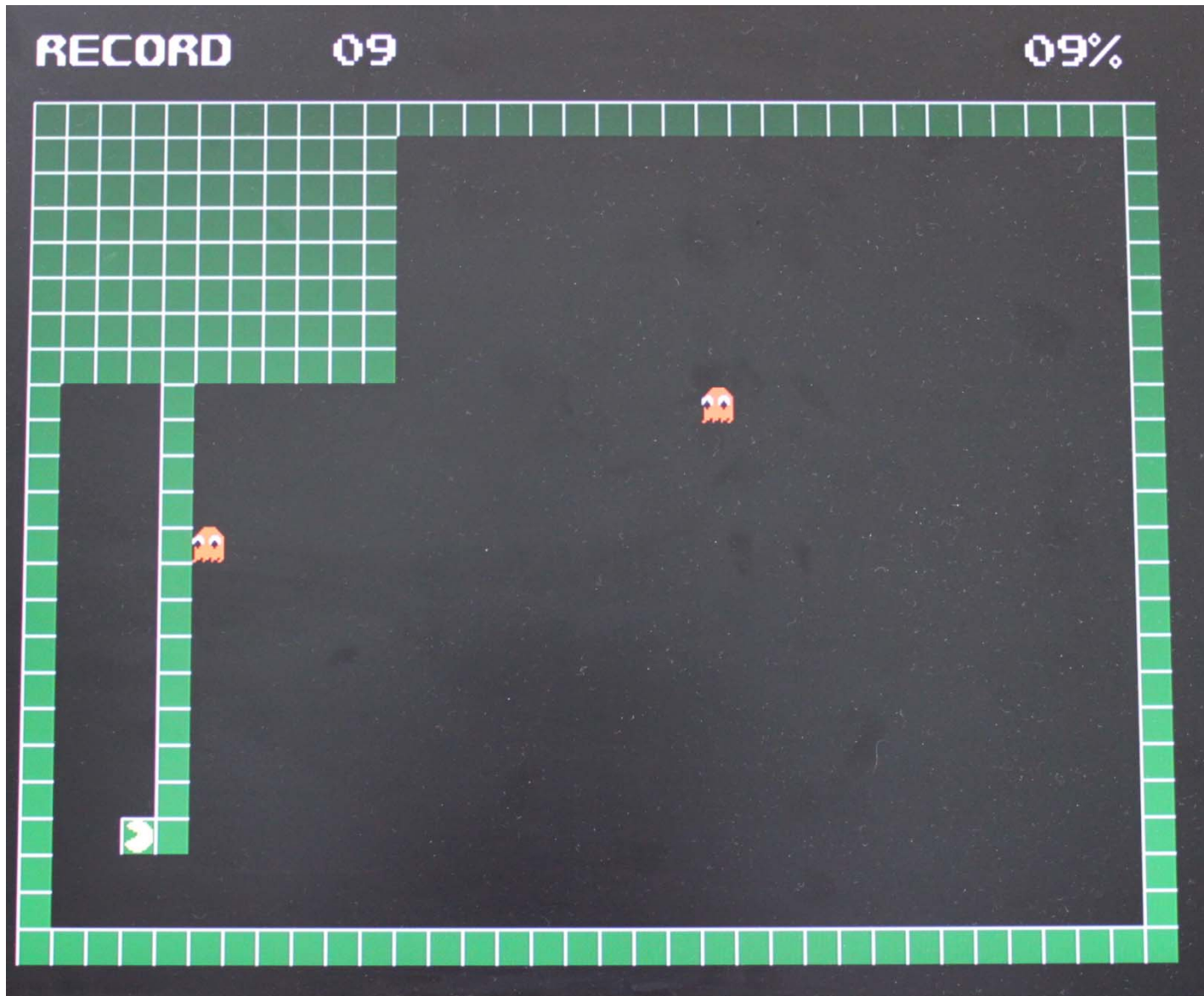
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Overview and Objective

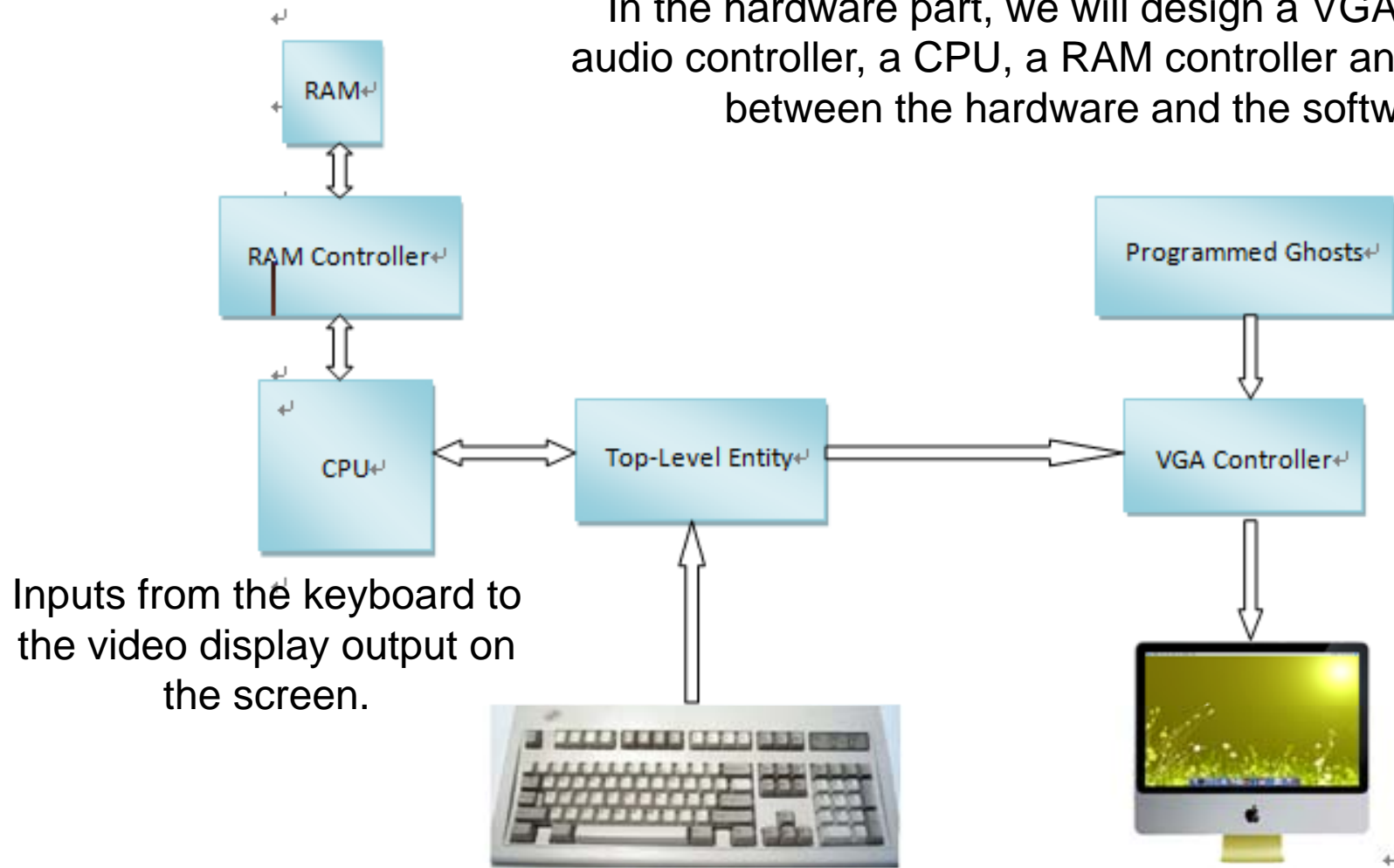
- ❖ We use the VGA output of the Altera board to present the game's graphics. Images will be initialized in hardware and pac-man and ghosts' movement done in software. The software will also control game logic. Player will play the game with the "  " keys on the PS2 keyboard.
- ❖ Players can also challenge the previous highest score which are recorded by the software.

Game Graphics



Design Architecture

In the hardware part, we will design a VGA controller, audio controller, a CPU, a RAM controller and a interface between the hardware and the software.



Design Architecture

Design Procedure

Hardware

| Component | Type | Requirement |
|----------------|-------------|--|
| Enclosure Wall | Sprite | Draw and Display by Hardware |
| Tiles | Sprite | Update by Software |
| Score & Record | Tile/Sprite | Read from Software |
| Pac-Man | Sprite | Draw by Software & Display by Software |
| Ghosts | Sprite | Draw by Software & Display by Software |

Game Graphics

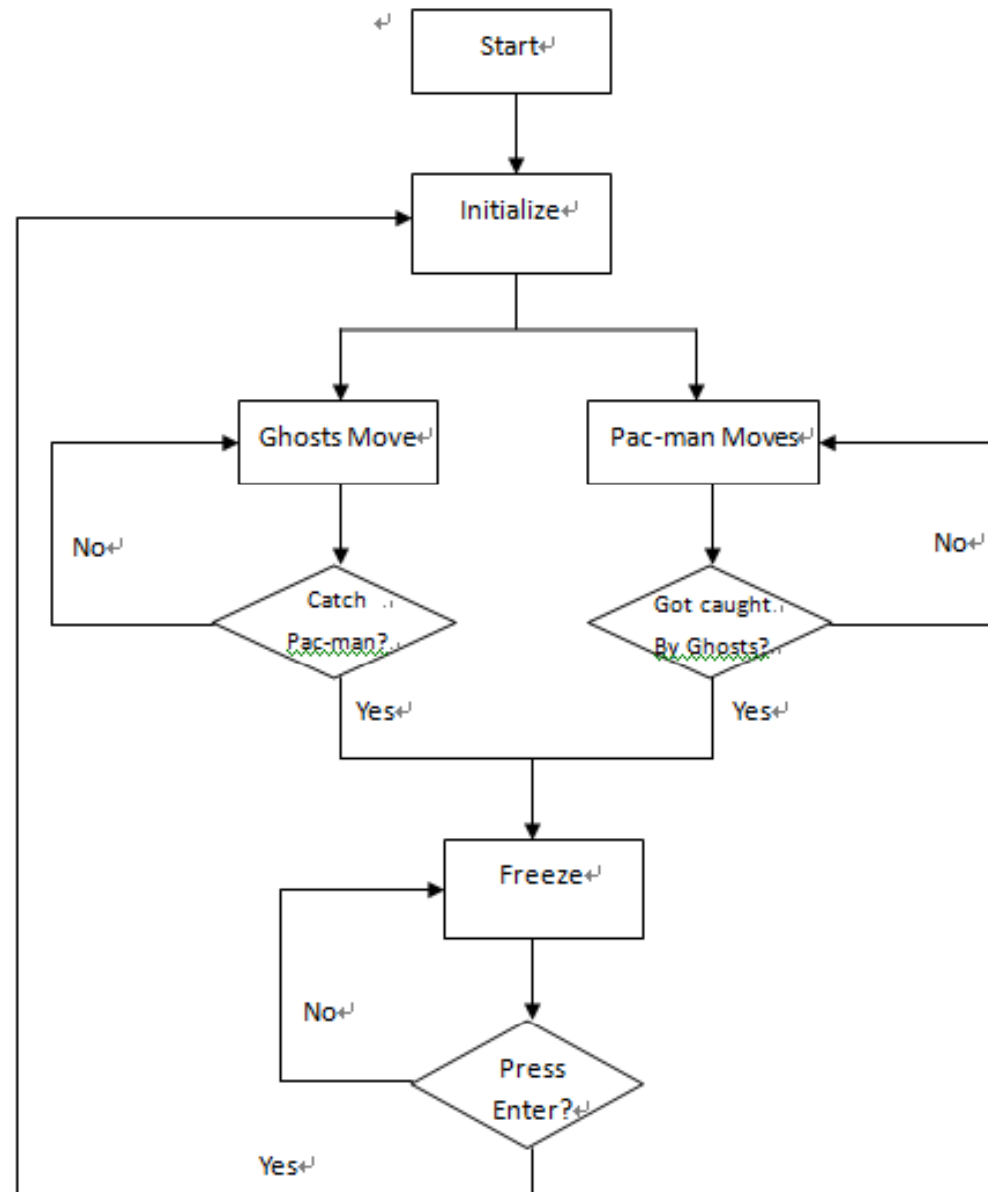
Design Procedure

| Address | Description |
|---------|--------------------|
| 0, 1 | Pan-Man's position |
| 2-23 | Play Area |
| 24 | Reserved |
| 25, 26 | Ghost1's position |
| 27, 28 | Ghost2's position |
| 29, 30 | Score |
| 31 | Pac-man Direction |
| 32, 33 | Record |

Memory Addresses for the Video Controller Device

Design Procedure

Software



Game Logic Flow Chart

Design Procedure

Software

States of the Game Area

| | | | | | | | | | | | | | | | |
|--|-----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | | | | | | | | | | | | | | |
| | 126 | 99 | 98 | | | | | | | | | | | 19 | 20 |
| | 125 | 100 | 97 | | | | | | | | | | | 18 | 21 |
| | 124 | 101 | 96 | | | | | | | | | | | 17 | 22 |
| | 123 | 102 | 95 | | | | | | | | | | | 16 | 23 |
| | 122 | 103 | 94 | | | | | | | | | | | 15 | 24 |
| | 121 | 104 | 93 | | | | | | | | | | | 14 | 25 |
| | 120 | 105 | 92 | | | | | | | | | | | 13 | 26 |
| | 119 | 106 | 91 | | | | | | | | | | | 12 | 27 |
| | 118 | 107 | 90 | | | | | | | | | | | 11 | 28 |
| | 117 | 108 | 89 | | | | | | | | | | | 38 | 29 |
| | 116 | 109 | 88 | | | | | | | | | | | 37 | 30 |
| | 115 | 110 | 87 | 82 | 81 | 76 | 75 | 70 | 56 | 51 | 46 | 41 | 36 | 31 | 31 |
| | 114 | 111 | 86 | 83 | 80 | 77 | 74 | 71 | 55 | 52 | 45 | 42 | 35 | 32 | 32 |
| | 113 | 112 | 85 | 84 | 79 | 78 | 73 | 72 | 54 | 53 | 44 | 43 | 34 | 33 | 33 |
| | | | | | | | | | | | | | | | |

WALL

PATH

GHOST

- 1.find the gost
- 2.if UP==YES, go to (2); if NOT, go to (3)
- 3.if RIGHT==YES, go to (2); if NOT, go to (4)
- 4.if DOWN==YES, go to (2); if NOT, go to (5)
- 5.if LEFT==YES, go to (2); if NOT, go to (6)
- 6.if Now==GHOST, finish; if NOT, position--, go to (2)

Experience and Lessons

Hardware:

At first we created the background and draw the sprites, but what we expected didn't show up because we forget about Initialization of some RAMs in our game. Each variable RAM we used in the game has to be initialized then it could be display or updated by software.

Experience and Lessons

Software:

In addition, after we have successfully built the play area, and started to focus on the software part. The most difficult part in the software design is that when we try to change in the state of the tiles as the pac-man or ghosts move, it is difficult to distinguish which part should be filled and which part should be left due to the movement of the ghosts. Here we use the concept of "connection" in graphics, which is starting from the two ghosts, check the four sides of the moving ghosts, then expand the checking area until it reach the real tiles that have no ghosts in there. By this method, we can change the states of the tiles in the play area.

Experience and Lessons

Audio Controller:

Furthermore, when we decided to add some sound to the game in order to make it more vivid, we came across a problem, we had to revise the port map to add some ports and signals from the Audio Controller, which took us a long time to check the ports one by one and rearranged them.

Thank You !

